

than ordinary richness. Many other similar examples of fairly active streams will be found as observations increase, and it will be necessary to single these out for special investigation.

Amongst the radiant points seen at Bristol during the last two years* a few others (in addition to those already specified) have exhibited signs of importance, and the dates and positions of these were as follows:—

	α	δ	
	$^{\circ}$	$^{\circ}$	\uparrow°
July 31—August 1	332 + 50		14 Lacertids.
July 31—August 1	12 + 70		16
July 31—August 1	321 + 31		10 } ζ Cygnids.
August 21-23	319 + 30		12 }
August 1-2	291 + 70		14 δ Draconids.
July 26—August 1	28 + 36		12 } Triangulids.
September 14-25	30 + 36		16 }
July 25-26	332 + 37		11
August 21-23	46 + 47		9 α Perseids.
September 14-25	99 + 43		15 } Lynceids.
October 14-20	95 + 46		11 }
September 21	31 + 19		10 Arietids.
{ September 14-25 }	{ 76 + 32		17 } Aurigids.
{ October 14-15 }	{ 77 + 57		19 }
October 15	106 + 23		11 Gemellids.
October 4-20	316 + 59		17 α Cepheids.

In each case the radiant may be regarded as accurate.

At the middle of September 1879 a shower was seen from α Aurigæ, and in July, September, October, and November many meteors have fallen from an exact centre 3° S. of α Cassiopeiæ.

Meteor Showers, 1870-1879. By Henry Corder, Esq.

(Communicated by W. F. Denning, Esq.)

The accompanying meteor radiant points have been culled from a list of about 230, chiefly observed between the years 1876-1879, the total number of meteors registered since 1870 being about 5,800, but of this time only the last three years have been made of much real use.

In mapping the meteors, rough star charts copied from an

* The results obtained up to the end of 1877 have already appeared in the *Monthly Notices*. See vol. xxxvi., pp. 283-89; vol. xxxvii., pp. 105-15; and vol. xxxviii., pp. 303-14.

atlas have been used out of doors, and the tracks afterwards laid down on tracing paper over the star charts of the British Association.

In observing the direction of a meteor's path the eye unconsciously prolongs it backwards or forwards to some bright star, and it is therefore found that a ruler held up as near as possible parallel with the track, especially if a streak is left, is a great help in mapping.

The time of watching has generally been from dark till 12 or 1, but occasionally morning watches have been made. Meteors are then more numerous, and the swift streak-leaving class in the best position for observation.

It has lately been found advisable to register all shooting stars in three classes:—

Class 1. The swift streak-leaving meteors.

Class 2. Slow meteors with trains.

Class 3. Small, quick meteors, with short paths, occasionally streak-leaving.

As types, may be selected:—

Class 1. Perseïds, Leonids, Lyrids, Orionids.

Class 2. Andromedes, Taurids I.

Class 3. Geminids.

Out of this year's total of 1,463 meteors (1879), the swift class took 43 per cent., the slow 17 per cent., and the remainder (40 per cent.) were of the small quick class.

The difference in the classes is exemplified by the number of streaks and trains.

Class 1. 63 streaks, 0 trains per cent.

Class 2. 2 „ 30 „ „

Class 3. 2 „ 0 „ „

The fireballs in either class may differ rather from the above. Swift streak-leaving fireballs may have a short train of sparks; and occasionally slow-trained meteors, Taurids for instance, leave narrow streaks; but as a rule these divisions hold good, and it is rarely difficult to tell in which a meteor should be placed. In mapping also they are kept distinct to prevent the chance of adding swift meteors to a radiant of slow ones, or *vice versâ*. Not unfrequently there are two radiants close together, and both active at about the same date. A good example was afforded in December 1877. The Geminids, of Class 3, were preceded by, and partly contemporaneous with, a shower of fine swift meteors,

Class 1. This latter radiant (No. 93 in the list) was extremely well defined when its long streak-leaving meteors were sifted out from the short insignificant ones radiating from a few degrees north.

As to colour in meteors, hardly enough have been seen yet to classify them sufficiently well to be of much interest.

About 10 per cent. of all the shooting stars show a distinct colour, the most usual being orange or red. The Taurids and other slow-moving meteors *seem* rarely to get warmed above a red heat; the large ones, or those going a long way, often turn from orange to bluish white like burning magnesium; sometimes the change is very sudden and startling.

Green is a tolerably common colour, especially in slow-moving fireballs about equal to *Venus* in lustre; they generally have a short train of red sparks.

A purple or mauve tint, like that given by copper, is occasionally noticeable.

The following notes have been made on some of the principal showers:—

Lyrids.—Usually white; some pale yellow. A pale green fireball probably also belonged.

Perseïds.—Characterised by deep orange in meteors equal to *Sirius* or *Jupiter*; in smaller 1st mags. yellow; in larger ones a pale green, the meteor suddenly bursting out into a flash like lightning, and leaving a reddish streak. About 20 per cent. show colour.

Orionids.—Not 10 per cent. coloured. First mags. are very rare, and are yellow. The rest white.

Leonids.—Streaks green, meteors yellow; but very few have been seen by the writer.

Andromedes.—A large number orange; also seldom observed.

Taurids.—Over 20 per cent. coloured, usually orange and red, but 1st mags. pale yellow-green, with faint red streaks.

Geminids.—Only 5 per cent. coloured. First mags. rare, generally primrose or white, but the larger ones emerald. One in 1879, deep orange red, was possibly a Geminid.

Geminorum.—The shower mentioned above as being almost contemporaneous with the Geminids. Two large meteors in 1877 were purple-mauve in colour.

Writtle, near Chelmsford,
1879, December.

List of Radiant Points of Meteors observed in 1876-9 by H. Corder, Writtle, Essex.

Class 1 = swift, streak-leaving meteors.
Class 2 = slow, trained meteors.
Class 3 = commonplace, short meteors, which rarely have streaks.

No.	Date.	R.A. °	Dec. °	Position or Name.	Remarks.	Class.	No. of ↓ ^s
1	Jan., middle	92 + 43		Auriga	A few seen each year.	3	15
2	"	55 + 35		Perseus	Fine meteors; not many seen 1877.	2	
3	Dec.—Jan.	130 + 53		θ-ι Ursæ Maj.	Three positions averaged.	1	
4	Jan.	70 + 26		Taurids III		2	3
5	Jan.—Feb.	128 + 27		ι Cancri	Regular, but feeble.	1	10
6	Feb.—March	172 + 62		Ursa Major	In 1877 only.	3	8
7	"	156 + 26		Leo Minor	" "	3?	10
8	Feb.—April?	98 + 37		θ Geminorum	Orange slow-trained meteors.	2	8
9	March	262 0		Ophiuchus	Fine long streaks.	1	3
10	"	280 + 65		Draco	Ill-defined position.	3	10
11	"	247 + 1		Serpens	Principal position out of several adjoining.	3	10
12	"	232 + 26		Corona	Small.	3	12
13	March—April	233 + 11		Serpens		3	12
14	"	200 + 55		ζ Ursæ	Small, short meteors.	3	10
15	"	210 + 23		Arcturus		3	6
16	March	180— 2		Virgo		2?	7
17	April	210— 7		"	Long continued in 1877.	2	10

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18	"	245 + 55	Quadrans	Badly observed.	1	
19	"	312 + 21	Cygnus		2	6
20	April 18-21	275 + 36	Lyrids	Generally white, fairly long meteors; larger ones yellow.	1	50
21	April	174 + 7	Virgo	Nearly all 4th mag.; long continued.	2 or 3	26
22	"	190 + 20	Coma		3	5
23	April-May	334 - 5	Aquariads	Fine long meteors at daybreak.	1	6
24	"	300 + 20	Sagitta		1	7
25	May	221 + 1	Virgo		2	5
26	"	227 - 8	"	Possibly the same shower.	2	9
27	"	273 + 55	Draco		3	12
28	June	197 + 45	Canum	Very short; seen at same spot (192 + 38) in March.	3	10
29	"	240 + 73	γ Ursæ Minoris		3	8
30	"	320 + 56	Cepheids	Well seen in 1877, but not much since.	1	14
31	"	260 - 4	Ophiuchus		2	28
32	May-Aug.	19 + 57 20 + 60	Cassiopeids	Almost the same position, but must be distinct showers; always seen in August.	1	
33	July &c.	333 + 12	Pegasis	Very diffuse; probably two positions.	1	40 13
34	"	332 + 48	Lacertids	" "	3	8
35	"	300 + 8	Aquilids	No defined position seen.	3	12?
36	"	6 + 40	Andromeda		1	4
37	July-August	295 + 55	Cygnids?	Two green meteors = <i>Jupiter</i> &c	2	4
38	"	337 - 13	Aquariads	Fine long meteors.	2	5

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No.	Date.	R.A. Dec.	Position or Name.	Remarks.	Class.	No. of ↓ ^s
39	August	44 + 56	Perseids	Largest meteors pale green; others orange &c.	I }	910
40	July—August	39 + 52	"	Several positions before the true Perseids.	I }	
41	August 17 &c.	307 + 65	Cepheus.	Regular shower.	I	18
42	"	304 + 58	"	Slow meteors.	2	7
43	"	298 + 55	"	Small quick meteors.	3	7
44	"	335 + 69	"		3	7
45	"	320 + 22	f Pegasi		I	9
46	"	23 + 72	Custos	Also 30° + 64° and 45° + 70°, doubtful.	3	11
47	August	62 + 48	μ Persei	Many other indistinct positions seen every year about the end of August.	I }	46
48	" end	53 + 44	ν Persei		I }	
49	August—Sept.	3 + 7	Pegasus	Seen in two years.	3	12
50	"	332 0	Aquariads	Slow, orange mets.; difficult position to distinguish.	2	12
51	"	351 + 4	Pisids		2 }	34
	"	3 — 2	"		2 }	
52	Sept.	30 + 40	Triangulum	All seen in 1877, and scarcely seen since; all of the streak-leaving class.	I	20
53	" middle	45 + 50	Perseus		I	20
54	"	72 + 18	Taurus		I	6
55	"	92 + 34	Auriga		I	6
56	"	80 + 30	"		I	7
57	"	50 + 20	Musca		I	10
58	"	5 + 50	Cassiopeia		3	9

59	"	294 + 23	Cygnus	3	7
60	"	297 + 50	"	2	7
61	"	331 + 48	Lacertids	3	14
62	"	15 + 16	η Piscium	3	13
63	"	45 + 34	β Persei	1	6
64	"	340 + 86	Polaris	3	12
65	Oct.	334 + 15	α Pegasi	3	7
66	"	320 + 80	κ-γ Cephei	1	9
67	"	75 + 45	Aurigids	1	13
68	"	11 + 22	Pegasus	3	7
69	"	20 + 25	η Andromedæ	3	8
70	"	30 + 20	Aries	1?	6
71	"	25 + 8	ο Piscium	2	60
72	"	32 + 11	ξ Ceti	3	
73	"	23 + 8	ο Piscium	3	
74	"	110 + 14	Canis Minor	1	9
75	"	127 + 54	ι Ursæ Majoris	1	17
76	"	106 + 27	Gemellids	1	8
77	"	32 + 34	Triangulum	3	13
78	"	16-22	Orionids	1	164
79	"	88 + 24	η Geminorum	1	
80	"	93 + 19	ν Geminorum	1	

Much finer meteors than 59.

Short meteors.

Fine meteors on one evening (7th 1879).

Fine meteors, slow, but with streaks.

Perhaps connected with 68.

Fine meteors.

There are several radiants of small meteors about this place and date difficult to distinguish.

Fine shower, but augmented by the following two. Very few large ones, but many streaks ; possibly all connected.

No.	Date.	R.A. °	Dec. °	Position or Name.	Remarks.	Class.	No. of V
81	Oct. 27	102	+ 19	ζ-γ Geminorum	Very swift; many streaks.	I	16
82	" 9-22	95	+ 34	θ Geminorum	Chiefly on Oct. 9, but more on 22nd? (distinct).	I	10
83	"	306	+ 64	ζ Cepheus	Poorly marked.	3	10
84	Oct.—Nov.	43	+ 15	f Tauri	Small meteors preceding true Taurids.	3	34
85	"	45	+ 47	Perseus	White, small meteors, long continued.	3	34
86	"	41	+ 13	Aries		3	13
87	"	51	+ 7	ο Tauri		I	14
88	Nov.	59	+ 20	Taurids	Always interesting; slow meteors.	2	195
89	"	148	+ 25	Leonids	Not properly mapped till 1879.	I	30
90	" 27 &c.	23	+ 44	Andromedes	Only a few seen.	2	30
91	"	140	+ 40	Ursites	Average of a number of vague positions.	I	30
92	"	205	+ 68	α Draconis		3	9
93	Dec. 9 &c.	108	+ 28	ι Geminorum	Fine long meteors; very different to 94.	I	20
94	" 10-13	107	+ 35	Geminids	Larger ones, pale green; very few streaks.	3	206
95	"	78	+ 23	Taurids II		2	20